

Award Number 99HQGR0066

**MONITORING THE SPATIALLY AND TEMPORALLY COMPLEX ACTIVE  
DEFORMATION FIELD IN THE SOUTHERN BAY AREA: COLLABORATIVE RESEARCH  
WITH UNIVERSITY OF CALIFORNIA, BERKELEY AND USGS, MENLO PARK**

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**Technical Abstract**

To better understand the rate of loading and seismic hazard of individual faults in the southern San Francisco Bay area we collect geodetic observations of crustal deformation using GPS and radar interferometry (InSAR). We compute slip at depth below major faults, which allows an estimate of long-term slip rate on locked faults. We are also able to resolve the broad distribution of locked and aseismically creeping segments and thus the earthquake potential along the Calaveras fault. The Calaveras fault is a major component of the San Andreas fault system in the San Francisco Bay area, having generated 13 earthquakes of  $M > 5$  since 1850. Mostly aseismic areas are believed to represent locked patches of the fault that are accumulating strain to be released in  $M > 5$  events. We model the slip distribution in the seismogenic zone by inversion of over 25 years of surface deformation data. Our discretized fault slip model consistently identifies regions of slip deficit in the seismogenic zone of the Calaveras fault that generally correspond to regions of decreased microseismicity and ruptures of previous moderate earthquakes. Moment magnitude calculations based on the estimated slip deficit and recurrence intervals agree with measured magnitudes of modern events and interpreted historical magnitudes. We also elucidate in greater detail active deformation in transition from locked to creeping behavior along the San Andreas fault in the aftermath of the 1989 Loma Prieta earthquake.

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**Non-Technical Abstract**

The southern San Francisco Bay Area is a complex region that experienced several significant historic earthquakes, including the 1989 Loma Prieta earthquake. To better understand the rate of loading and seismic hazard of individual faults we collect geodetic observations of crustal deformation using GPS and radar interferometry (InSAR). We compute slip at depth below major faults, which allows an estimate of long-term slip rate on locked faults. We are also able to resolve the broad distribution of locked and aseismically creeping segments and thus the earthquake potential along the Calaveras fault. We also elucidate in greater detail active deformation in transition from locked to creeping behavior along the San Andreas fault in the aftermath of the 1989 Loma Prieta earthquake.